RxMix – Use of NLM drug APIs by non-programmers

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Motivation

Subject matter experts, including pharmacists, pharmacy benefit managers, health researchers and health data analytics specialists, are generally knowledgeable in drug resources, such as RxNorm, and have developed interesting use cases for it. However, processing datasets often requires programming skills, e.g., making calls to a service, such as the RxNorm Application Programming Interface (API). To enable users who do not have programming skills to leverage National Library of Medicine (NLM) drug APIs, we developed *RxMix*, a web application designed for non-programmers to create queries for complex use cases and execute batch queries against our APIs.

NLM drug Application Programming Interfaces (APIs) available through *RxMix*

Over the past decade, NLM has developed a variety of publicly available drug APIs to expose some of its resources through SOAP and RESTful web services for users to integrate into applications (https://rxnav.nlm.nih.gov/). API usage reached 1 billion queries in 2015. We also make these APIs available through RxMix.

- The *RxNorm API* enables users to access *RxNorm* drug names and codes. The most common use is for mapping drug identifiers (e.g., NDC codes) to *RxNorm*. It can also be used to map drug names from local formularies to *RxNorm* using normalization and approximate matching. The APIs is useful for traversing the rich graph of relations among drug entities provided by *RxNorm*. Recently developed functions help access historical drug codes for analytics purposes.
- The *RxClass API* enables users to access drug classes and drug members for a number of different drug class types, including ATC, DailyMed and NDF-RT. It can be used to find the classes for a particular RxNorm generic or brand name drug, or can list the ingredient members of a specified drug class.
- The *Interaction API* enables users to find drug-drug interaction (DDI) information for a specified drug or find the interactions from a list of drugs. Sources of DDI include DrugBank and the ONC high-priority list of DDIs.
- The *RxTerms API* provides access to the physician-friendly display names for clinical and branded drugs in e-prescribing applications.
- The *NDF-RT API* enables users to access clinically-oriented information associating drugs with their pharmacologic classes and other properties (e.g., mechanism of action and physiologic effect).
- The *DailyMed API* provides access to drug information from the FDA Structured Product Labels.
- The *RxImageAccess API* provides access to pill images as well as their related properties.

RxMix – Complex queries and batch processing

Using the RxMix graphical interface (https://mor.nlm.nih.gov/RxMix/), users can select an API function apply it in batch mode to a list of input values. For example, a list of identifiers from the National Drug Code found in a claims database can easily be mapped to RxNorm identifiers using the function *RxNorm:findRxcuiById*. The batch query is executed on NLM servers and the results are returned to the users after completion.

Users can also create complex workflows (i.e., sequences of API functions) for specific use cases. RxMix "knows" which functions are interoperable and helps guide users in workflow development. Users can also select existing workflows from a library and save their own workflows for future use. Use cases suggested by users include mapping drug codes found in observational datasets to drug classes for analytics purposes and identifying non-opioid analgesics in a list of analgesics that includes multi-ingredient drug products.

All queries and workflows can be tested interactively in RxMix, which makes it a powerful educational resource. RxMix receives 150-200 batch queries and 1800 interactive queries each month on average.